

Application No.: 10/586,174
Amendment Dated: December 29, 2008
Reply to Office Action of: September 30, 2008

MAT-8868US

Amendments to the Drawings:

The attached sheet of drawing includes changes to Fig. 4. This sheet replaces the original sheet.

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Remarks/Arguments:

Claims 1 and 3-6 are pending in the application. Claims 1 and 3-5 are rejected, and claim 6 is newly added.

The present invention relates to the detection of an abnormality of a capacitor in a power supply. Specifically, the invention is able to detect three different abnormal conditions.

On page 3, the Official Action objects to claim 1 because of the recitation of "just" and "at most." The Examiner states that these terms are vague and indefinite. Thus, Applicants have amended claim 1 to remove the recitation of "just" and "at most." Withdrawal of the objection is respectfully requested.

In entering a national phase of the above-identified application, Applicants mistakenly cancelled claim 2. Thus, Applicants have added new claim 6 to the application which is similar to the previously cancelled claim 2. The features in new dependent claim 6 are found on at least page 4, lines 19-20 of the specification as filed. No new matter has been added.

Applicants have also mistakenly described the series of interconnected capacitors as "M." Specifically, in Fig. 4, and on pages 3 and 4 of the specification, Applicants labeled the series of capacitors as "M series." This contradicts at least pages 6 and 7 of the specification where the short failed capacitor is also defined as "M." Thus, Applicants have amended page 3, line 3, page 4, lines 3-4 and Fig. 4 of the specification to replace the recitation of "M" with the recitation of "P." This amendment now defines the series of capacitors as "P."

On page 3, the Official Action rejects claims 1 and 4 under 35 U.S.C. § 103(a) as being obvious over Rokuto (JP 2000-287373) in view of Okamura (U.S. Patent No. 5,969,505). It is respectfully submitted, however, that the claims are patentable over the art of record for the reasons set forth below.

Rokuto teaches a charging circuit where two capacitors are connected in series. Across the capacitors is a detection circuit in order to detect an over voltage condition. Okamura teaches a system that monitors capacitors in series. Specifically, Okamura

has an arithmetic unit that performs logical operations representing the state of charge of the capacitors.

Applicants' invention, as recited by claim 1, includes a feature which is neither disclosed nor suggested by the art of record, namely:

... the determining unit is adapted to determine that a capacitor of the capacitor unit is abnormal based on at least two of the following conditions: ...

a) over-voltage abnormal condition ...

b) under-voltage abnormal condition ...

c) negative voltage abnormal condition ...

Claim 1 relates to a unit that measures voltage across a series of capacitors and is able to determine various abnormal conditions. Specifically, an over voltage abnormal condition is determined when a voltage across the capacitor exceeds an upper limit voltage. An under voltage abnormal condition is determined when the voltage across the capacitor is lower than a lower limit voltage. A negative voltage abnormal condition is determined when the voltage value across the capacitor is negative in polarity. This feature is found in the originally filed application on page 2, lines 12-17 and page 4, line 8 to page 5, line 10. No new matter has been added.

In Fig. 1, Rokuto teaches a charging circuit where two capacitors 5 and 6 are connected in series. Across each of these capacitors, there is a detection circuit 7 and 8 as well as additional capacitors 9 and 10. In one example, if the capacitor reaches a predetermined threshold value, detection circuit 7 controls thyristor element 13 to conduct therefore connecting capacitor 9 in parallel with capacitor 5. By connecting these capacitors in parallel, over voltage protection is provided. In another example, as shown in Fig. 8 of Rokuto, there exists an additional detecting circuit 30 which is also in parallel with detecting circuit 26. If the voltage across the capacitor 25 and 27 continues to exceed the rated voltage for a predetermined amount of time, it is detected by detecting circuit 30 which turns on indicating lamp 32. Indicating lamp 32 is utilized to indicate deterioration of the capacitor. This particular determination is only used for when the capacitor is deteriorating as an open circuit (over voltage condition). This feature is found in at least Rokuto's abstract ("*when the voltage of*

capacitor 25 reaches rated voltage at the time of charging operation, it is detected by the first voltage detecting circuit 26, and a thyristor element 28 is turned on, so that an adjustment capacitor 27 is energized. ... the contact of relay 31 is turned on and an operation indicating lam 32 is lighted").

In similar art, Okamura teaches a system that monitors capacitors in series. Specifically, monitor 12 as shown in Fig. 2 of Okamura bypasses the charging current at voltages exceeding a preset threshold. On page 5, the Official Action suggests that arithmetic unit 11 is able to compute the voltage difference between the adjacent series capacitors. Applicants, however, respectfully disagree. Col. 3 of Okamura suggests an arithmetic unit 11 that performs logical operations which represent the state of charge of the capacitor (*"the arithmetic circuit 11 performs logical operations, for example, on the signals and produces the output signal VC representing the state of charge"*). Okamura's arithmetic unit 11 does not compute the voltage difference between the adjacent series capacitors.

Applicants' claim 1 is different than the combination of Rokuto and Okamura because a determination unit is able to determine at least two of three possible abnormal conditions (*"... the determining unit is adapted to determine that a capacitor of the capacitor unit is abnormal based on at least two of the following conditions: ... a) over-voltage abnormal condition ... b) under-voltage abnormal condition ... c) negative voltage abnormal condition ..."*). As cited on page 2, lines 12-17 of the specification, Applicants teach three different abnormal conditions that are determined (*"determines the abnormality when difference between respective voltages on the high potential sides of some adjacent capacitors exceeds upper limit voltage value Va, when the difference is lower than lower-limit voltage value Vb, or when one of respective voltages is negative."*). Thus, claim 1 is able to determine three distinct abnormality conditions (over voltage, under voltage and negative voltage). Further support for these three limitations can be found in Applicants' specification on page 4, line 19 to page 5, line 10 and page 6, lines 18-23 (*"... upper limit voltage value Va ... failure can be determined when the voltage capacitor is lower than at least half the above-mentioned value ... When the voltage of a capacitor is negative, an abnormality is determined"*). In contrast, both Rokuto and Okamura suggest determining an over voltage abnormality condition. Neither of these references suggest an under voltage abnormality or a negative voltage abnormality condition. Thus, Rokuto and Okamura

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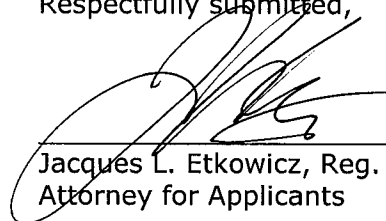
are only able to determine one of the three abnormalities recited in Applicants' claim 1 (over voltage abnormality). They cannot determine at least two of the abnormality conditions.

It is because Applicants include the feature of "*the determining unit is adapted to determine that a capacitor of the capacitor unit is abnormal based on at least two of the following conditions: ... a) over-voltage abnormal condition ... b) under-voltage abnormal condition ... c) negative voltage abnormal condition ...*," that the following advantages are achieved. An advantage is the ability to determine different types of abnormality conditions (over voltage, under voltage, and negative voltage abnormalities). Accordingly, for the reasons set forth above, claim 1 is patentable over the art of record.

Dependent claims 3-6 include all the features of claim 1 from which they depend. Thus, these claims are also patentable over the art of record for the reasons set forth above.

In view of the amendments and arguments set forth above, the above-identified application is in condition for allowance, which action is respectfully requested.

Respectfully submitted,



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RAE/so

Attachment: Fig. 4 (1 sheet)

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